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TENNESSEE VALLEY AUTHORITY

ANALYSIS OF SULFUR DIOXIDE EXCESSES AT ALLEN STATION 7 DURING DECEMBER 1980

Prepared by

Kenneth G. Wastrack

Air Resources Program

AIR RESOURCES PROGRAM

TVA/ONR/ARP-81/10

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Office of Natural Resources

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Muscle Shoals, Alabama

July 1981

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ANALYSIS OF SULFUR DIOXIDE EXCESSES AT ALLEN STATION 7 DURING DECEMBER 1980

Scope and Objectives

During December 1980, sulfur dioxide (SO_2) levels in excess of primary National Ambient Air Quality Standards (NAAQS)[1] were measured at monitoring station 7 near the Tennessee Valley Authority (TVA) Allen Steam Plant on two occasions. SO_2 concentrations exceeding the 24-hour primary standard of 0.14 ppm were measured for the period ending at 1500 CST on December 1, 1980 (0.143 ppm), and at 2000 CST on December 18, 1980 (0.144 ppm). Since two excesses occurred within a single calendar year, these excesses represent a violation of the primary standard.

Allen Steam Plant was in compliance with the 4.0 $lbs/10^6$ Btu SO_2 emission standard at the time the excess occurred. Therefore, excesses of NAAQS were unexpected and an analysis is necessary to identify the cause(s) of these excesses, with particular emphasis on possible contributions from Allen Steam Plant.

This report examines the physical and environmental circumstances associated with the December incidents, documents these circumstances as completely as practical, and determines the sources in the vicinity of station 7 that were contributors to the incident. Data bases used during this investigation included: TVA meteorological and air quality data from the Allen Steam Plant monitoring network, National Weather Service data, topographic maps, and Allen operational data. This report presents and evaluates all available data and information related to the December 1980 measurements.

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1. For SO_2 the primary standard (for protection of public health) is 0.14 ppm for a 24-hour average; the secondary standard (for protection of public welfare) is 0.50 ppm for a 3-hour average. These standards are not to be exceeded more than once per year.

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Physical and Environmental Factors

This section discusses the relevant physical and environmental factors which include the (1) Allen Steam Plant vicinity, (2) emissions from sources with the potential to impact station 7, and (3) meteorological and air quality monitoring data.

Allen Steam Plant Vicinity

Steam Plant Environment--Allen Steam Plant is located along the Mississippi River in the southwest section of Memphis, Tennessee. It is located in an undeveloped area along the south shore of an arm of the river with the main channel of the Mississippi River about 2.5 kilometers (km) to the west. Terrain in the immediate vicinity is marshy, low-land floodplain, with the steam plant located on a built-up portion along the levee. The industrial and residential portions of Memphis are located within 2-6 km to the northeast and east.

Allen monitoring station 7 is located in an urban area 6.6 km east-northeast of the steam plant at an azimuth of 66°. The station is located in a park near downtown Memphis and is approached from an adjacent paved parking lot to the south. Within 200 meters (m) surrounding the site, there is no heavy or light industry and housing is negligible. There are no tall structures or trees that do not meet the minimum distance criteria for SO_2 monitoring at this site. This site does not meet SLAMS criteria[2] for

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2. SLAMS: State and Local Air Monitoring Station siting criteria. These criteria have been established as part of standardized air monitoring guidelines for monitor location, data collection and processing, and instrument calibration.

   40 CFR Part 58. "Ambient Air Quality Surveillance."

siting SO_2 monitors because it is too close to the parking lot to the south. However, due to the extremely light traffic in the parking lot, the data are not considered biased or unrepresentative.

Air Quality and Meteorological Monitoring--TVA operates a network of 5 air monitoring stations in the vicinity of Allen Steam Plant (figure 1). At each station, SO_2 is continuously monitored coulometrically with a Philips PW-9700 ambient monitor.

A TVA-operated meteorological tower is located near Allen Steam Plant. Temperature is measured at three levels (1 m, 10 m, and 110 m); and wind speed, wind direction, and wind direction persistence are measured at one level (110 m). In addition, solar radiation near the surface is measured continuously. All data are summarized hourly.

During December 1980, SO_2 concentrations in excess of the primary ambient air quality standard (0.14 ppm--24-hour average) were measured on two occasions.

Date	Ending Time (CST)	Monitoring Station	24-Hour Average SO_2 Concentration (ppm)
December 1, 1980	1500	7	0.143
December 18, 1980	2000	7	.144*

*23-hour average--1 hour of last record data not included (power outage).

Complete listings of SO_2 concentrations for these periods are included in appendix A. Meteorological data are listed in appendix B.

Survey of SO_2 Emission Sources

Several area and point sources of SO_2 exist which could conceivably impact Allen monitor 7. A list of all major point sources of SO_2 in the vicinity of Allen Steam Plant is presented in appendix C.

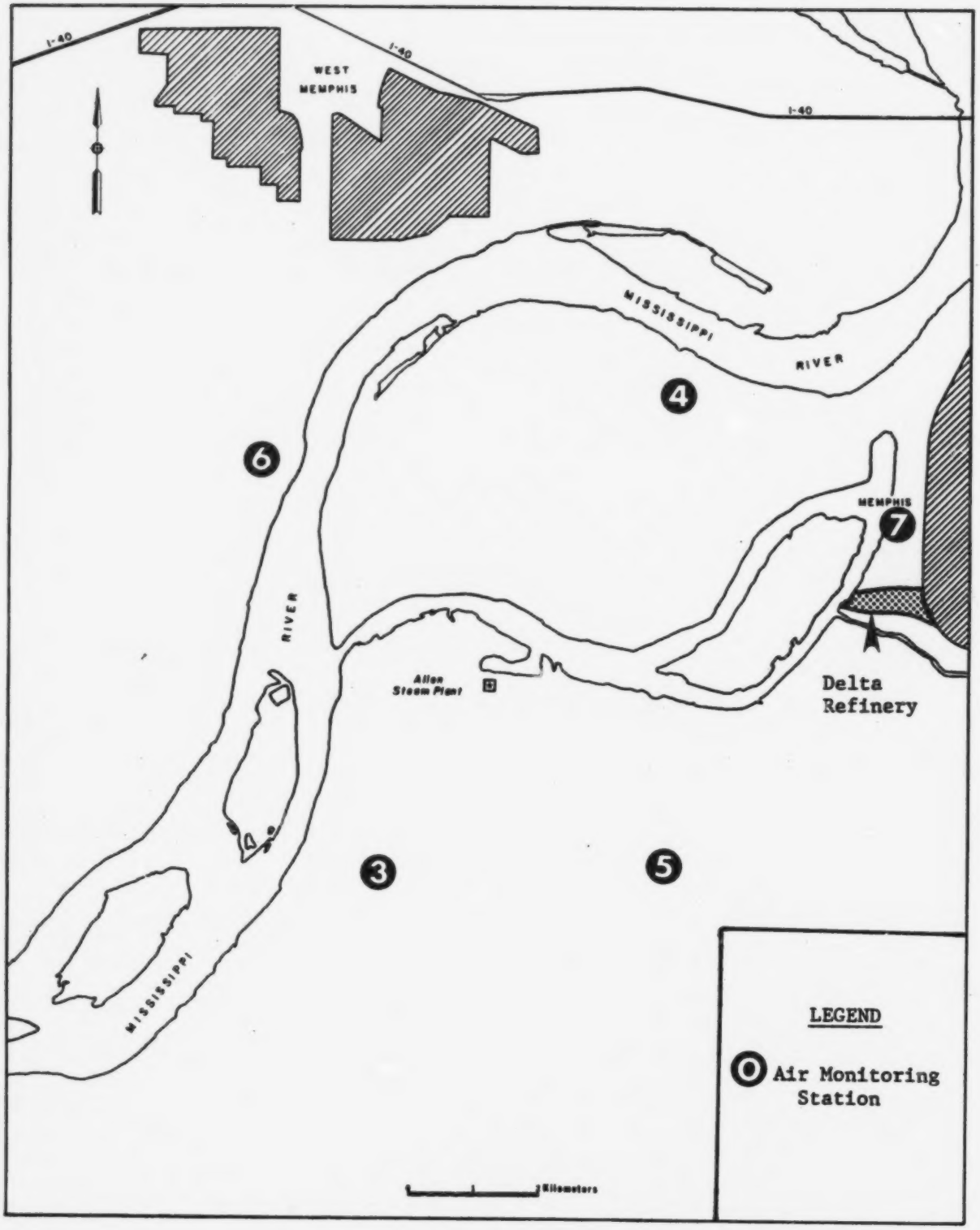

Figure 1. ALLEN STEAM PLANT AMBIENT AIR MONITORING NETWORK

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Allen Steam Plant--Allen Steam Plant consists of three coal-fired units which exhaust flue gases through three 122-m stacks. It has a rated capacity of 990 megawatts (MW), and is the largest emitter of SO_2 in the vicinity of monitor 7 with estimated emissions of 3000 grams per second (g/sec).

Delta Refinery--Delta Refinery consists of several boilers and kilns used in petroleum refining processes which exhaust flue gases through several stacks up to 69 m high. The refinery is located 1.2 km south of station 7 and has estimated SO_2 emissions of 615 g/sec.

Other Nearby Point Sources--Several other SO_2 emission point sources are located near monitor 7, but they are generally too small or too distant to be significant.

Nearby Area Sources--Area sources of SO_2 include residential heating, commercial/institutional fuel usage (primarily heating), fuel burned by light industry, incineration, highway and off-highway vehicles, and open burning. In general, these emissions are population-related and result from the combustion of sulfur-containing fuels. Major industrial point sources are not included when determining area source emissions. Monitoring station 7 is surrounded by the Memphis metropolitan area, with the bulk of the urban area to the east and south. However these area source emissions are a minor influence at monitor 7.

Meteorological Factors

Both incidents were similar in terms of weather conditions. Winds were extremely persistent from the south-southwest of approximately 12 meters per second (m/sec). The table below summarizes the wind conditions during the excess period.

SUMMARY OF SIGNIFICANT WEATHER CONDITIONS

Parameter	November 30-December 1, 1980 Average	November 30-December 1, 1980 Range	December 17-18, 1980 Average	December 17-18, 1980 Range
110-m wind direction (°)	197	189-202	203	195-209
110-m wind speed (m/sec)	12.1	9.5-13.9	11.8	9.9-13.3
110-m wind direction persistence (%)	90	74-94	99	98-100

Temperature stability patterns (based on 10-110 meter temperature difference) were also similar during both cases. Nighttime conditions were slightly stable, becoming unstable during the daytime; daytime conditions were more stable on December 18, 1980 (stability class A as opposed to stability class B December 1, 1980) due to slightly less solar radiation.

The similarity of local meteorological conditions resulted from almost identical large-scale weather patterns. During both incidents, a low-pressure system was located over western Oklahoma with a cold front extending east-northeastward toward the Great Lakes region in the vicinity of Detroit. High pressure dominated the southeastern part of the country with the high centered over the Atlantic Ocean on December 1, 1980 and over the Gulf of Mexico on December 18, 1980.

The combination of a cold front to the northwest and high pressure to the southeast resulted in extremely constant wind directions with moderate wind speeds in the Memphis vicinity.

Nature of Excesses

There are several forms an excess might take. An excess at one site might represent the maximum of elevated concentrations observed at all or a number of sites in a network. Alternatively, it could be an isolated event which affects one monitor, but not any of the others. The persistence of high

concentrations during an excess must also be considered. The nature of an excess, i.e., the spatial distribution and persistence of high concentrations, is important when attempting to identify sources which might be responsible.

The following observations about the nature of the excesses are based on a review of network ambient air monitoring data and of the actual strip-chart recording during the excess.

1. No other station in the Allen monitoring network measured SO_2 above background levels. This indicates a nearby source as opposed to a distant source which might have impacted several monitors.

2. Elevated SO_2 concentrations occurred during 3 or 4 short time periods (2-5 hours in length) with significantly lower concentrations during the intervening period. This indicates of a source with greatly fluctuating emissions or significant shifts in wind direction combined with relatively constant source emissions.

3. The SO_2 strip-chart traces were characterized by a jagged trace with sharp peaks, not a flat trace. This is characteristic of the SO_2 concentration pattern associated with a single large point source.

4. Peak and hourly average SO_2 concentrations followed the same increase/decrease trend during the high concentration period. Hence, as hourly averages increased or decreased, so did peaks, although changes were not at the same rate. This is indicative of a single plume shifting direction as the centerline first moved closer to the station and then moved away from the station.

5. Wind directions during the period of elevated SO_2 concentrations were generally constant with hourly average directions of 189-209°. This indicates the emission source(s) contributing to the excesses is located south-southwest of Allen monitor 7.

These observations indicate that monitoring station 7 was probably influenced by a large, isolated, nearby SO_2 emission source(s). Distant emissions (greater than 10 km away) were not a significant factor in the excess.

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Assessment of Probable Contributors

In the previous section topographic, meteorological, and other factors important to determining the cause of the excesses were examined. In this section, sources which might have contributed to the excesses and the probable impact of each are discussed.

It is useful to examine the relationship between SO_2 concentrations and wind directions to see if any particular condition were present during elevated levels. A convenient method of illustrating this is a pollution rose, which is a graphical display of the frequency that various combinations of wind directions and pollutant levels occur. Figures 2a and 2b are maps of the Allen Steam Plant area with pollution roses at station 7 representing the periods of high SO_2 measurements.

In both cases, winds were from the south-southwest for the majority of the period when elevated SO_2 concentrations were measured. The probable source of SO_2 emissions is located south-southwest of monitoring station 7.

Probable Impacts of Potential Sources

Allen Steam Plant--TVA's Allen Steam Plant is the largest SO_2 source in the vicinity of monitoring station 7, and therefore must be considered a likely source. However, it is unlikely that this was the case since at no time during the period of elevated SO_2 concentrations was the wind from a direction to transport the Allen plume toward monitor 7.

Winds would have to be from the west-southwest (246°) for the Allen plume to be carried over monitor 7. To hypothesize Allen plume impact at monitor 7, it is necessary to develop some mechanism to cause the plume to

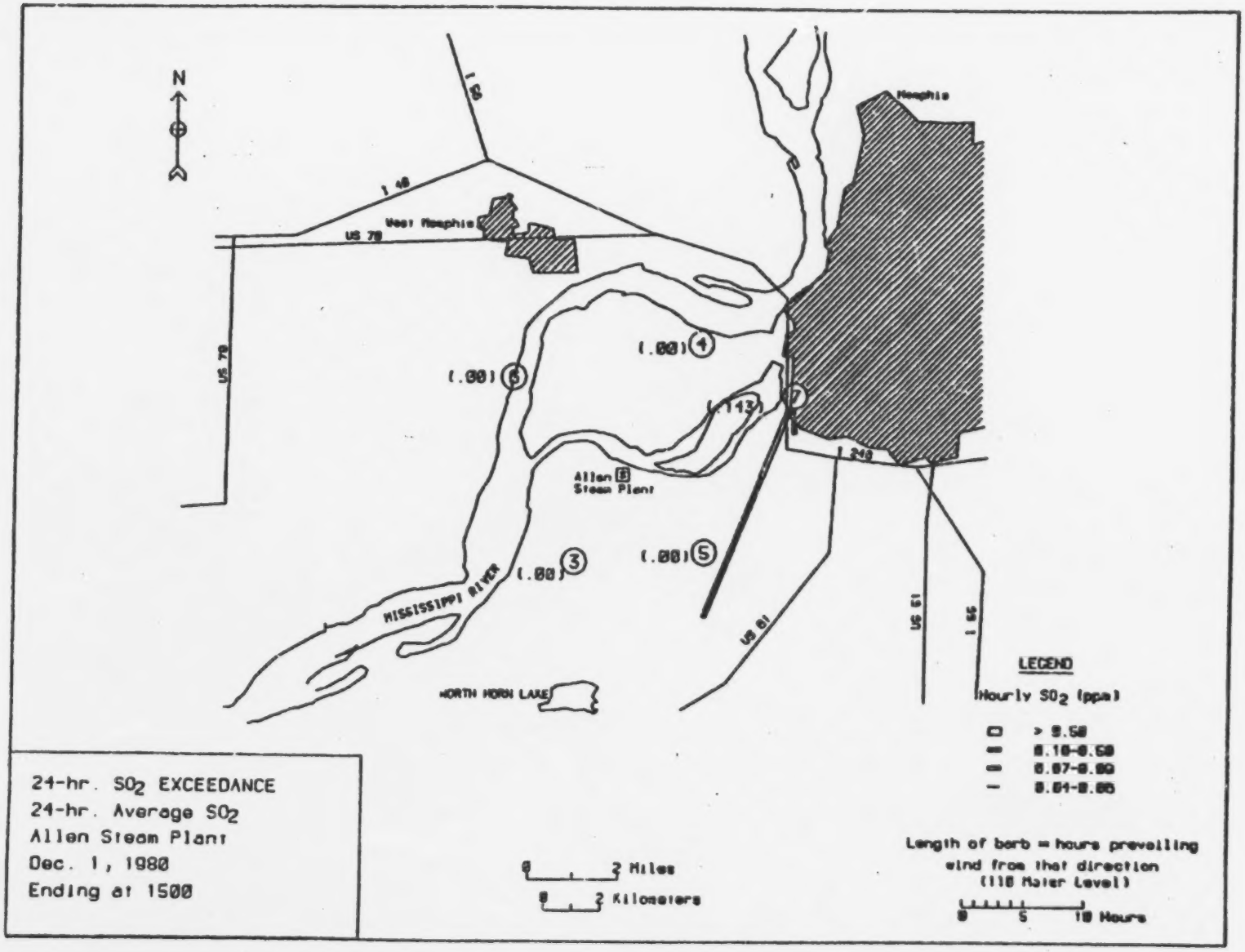

Figure 2a. ALLEN STEAM PLANT POLLUTION ROSE MAP - NOVEMBER 30-DECEMBER 1, 1980

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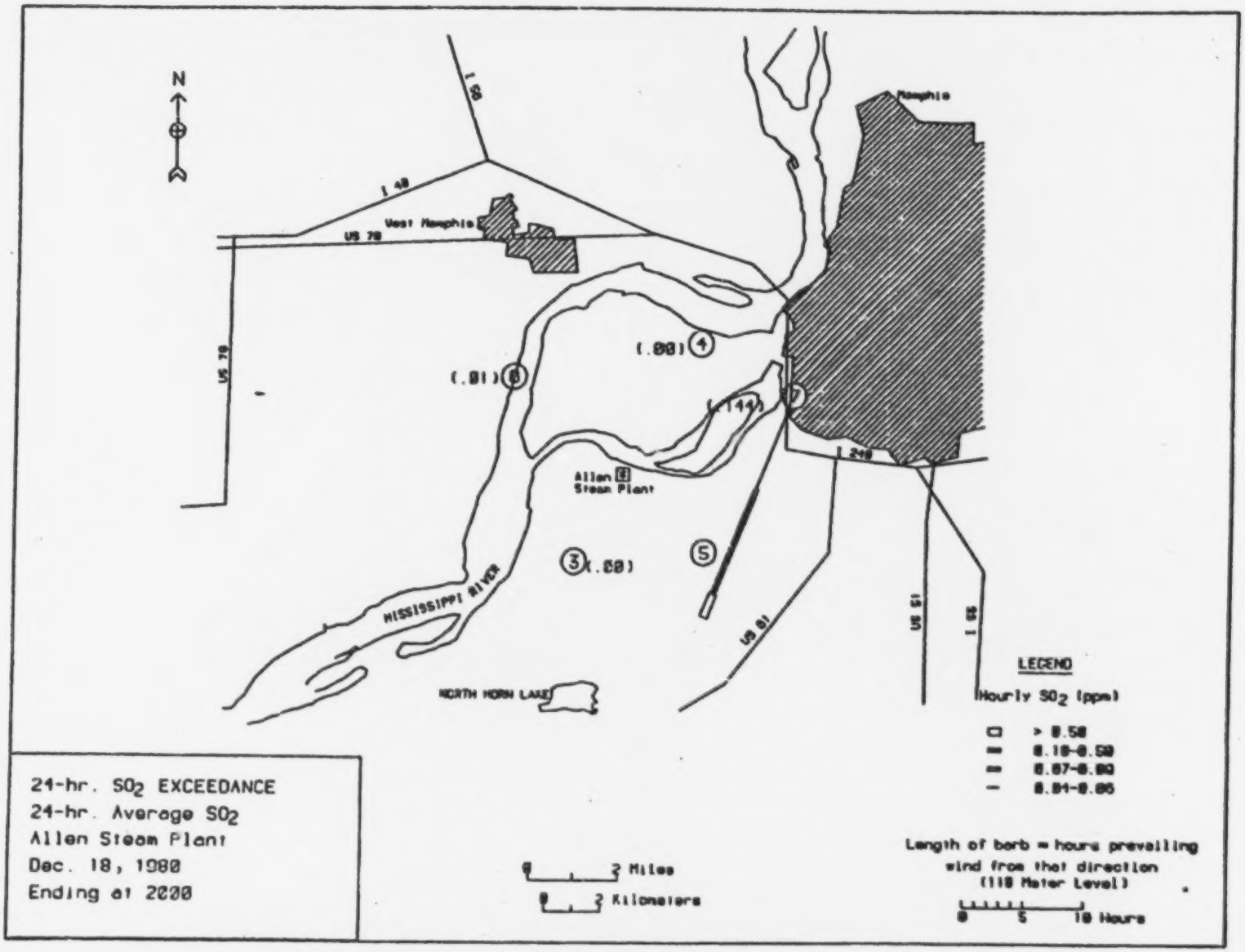

Figure 2b. ALLEN STEAM PLANT POLLUTION ROSE MAP - DECEMBER 17-18, 1980

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move at least 40° out of phase with the observed wind direction, a virtual impossibility considering meteorological conditions during the incidents.[3]

A modeling analysis of each incident confirmed that standard models would predict no concentration at station 7 as a result of Allen Steam Plant emissions (appendix D).

Delta Refinery--Delta Refinery is located 1.2 km south of station 7 with estimated SO_2 emissions of 615 g/sec. Delta Refinery is approximately 1.3 km across from east to west, so it covers an arc south-southeast through southwest from station 7. Therefore, part of Delta Refinery was directly upwind from station 7 during both elevated SO_2 incidents. Calculations[4] indicate that Delta Refinery could produce estimated SO_2 concentrations at station 7 as high as 0.40 ppm--sufficient to cause a 24-hour excess.

Other Possible Sources--There are several other SO_2 emission sources in the vicinity of station 7. However, they are generally too small and far away to have caused a significant impact. Additionally, except for Delta Refinery, there are no SO_2 emission sources south-southwest of station 7.

Special Factors

Two factors are important in examining these excesses. First, winds were both strong and persistent and, therefore, would have resulted in a much

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3. A study of wind speed and directional variability was conducted during development of Sulfur Dioxide Emission Limitation (SDEL) Program software. Using the results of this study, a maximum wind direction change of only $\pm$ 7° would be expected given the wind speed conditions that existed--far less than the 40° necessary for Allen plume impact to occur.

4. Equation 3.3

   "Workbook of Atmospheric Dispersion Estimates," D. Bruce Turner, Environmental Protection Agency, 1974. Emission parameters were estimated in some cases to conduct calculations.

tighter plume than might be otherwise the case. This would produce less dispersion (smaller σ's) and less plume rise (lower effective plume height). Calculations assuming these characteristics would indicate higher ground-level concentrations than would normally be the case. Therefore, at least theoretically, a source would be capable of producing higher ground-level concentrations.

Second, the SO_2 monitor at station 7 was calibrated by TVA after both excesses and determined to be reading high in the range of interest (Appendix A). This was determined by defining the equation of the line connecting two calibration points, substituting the average SO_2 concentration into this equation, and calculating the actual concentration. On November 30-December 1, 1980, the monitor was measuring about 28 percent high while on December 17-18, 1980, the monitor was reading about 4 percent high. This converts to actual 24-hour average values of 0.112 ppm and 0.138 ppm--both below the primary standard.

While monitor 7 generally reads high (about 4 percent at an ambient concentration of 0.140 ppm) based on the history of TVA calibrations, an audit of the SO_2 monitor by the State of Tennessee on February 10, 1981 indicated the monitor was actually reading about 4 percent low.

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Conclusions

1. Allen Steam Plant was probably not a significant contributor to the 24-hour SO_2 excesses measured at station 7 during November-December 1980. This conclusion is based on existing wind conditions which would not have transported the plume towards the station.
2. The most likely cause of the 24-hour SO_2 excesses measured at station 7, was Delta Refinery. This is based on estimated plant emissions combined with existing wind conditions which would have transported the emissions toward station 7.

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APPENDICES

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APPENDIX A

Ambient Air Quality Data

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Table A-1

AIR MONITORING NETWORK

ALLEN STEAM PLANT

December 1980

Monitor Number	From Allen Steam Plant		Pollutants Measured[a]	Elevation Above Plant Grade (m)
	Azimuth (°)	Distance (km)		
3	212	3.3	SO_2, NO_2	-1
4	32	5.2	SO_2, NO_2	-6
5	134	3.8	SO_2, NO_2, TSP	20
6	312	5.1	SO_2	-10
7	66	6.6	SO_2, NO_2, TSP	1

a. SO_2 = Sulfur Dioxide

NO_2 = Nitrogen Dioxide

TSP = Total Suspended Particulates

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Table A-2

AMBIENT AIR QUALITY DATA

November 30-December 1, 1980

ALLEN STEAM PLANT — TENNESSEE VALLEY AUTHORITY — PRINT-DATE 12/24/80
STA 66 11 — AMBIENT AIR CONCENTRATIONS (PPM) — VALIDATED
80:335 11/30/80 (NOVA)

PERD ENDG (CST)	PREV WD 110M Q188	WIND SPEED 110M Q1E8	SO2 PEAK STA 4 (0332) AD	SO2 AVG STA 4 (212) BC	NOX AVG STA 4 (212) VC	NO AVG STA 4 (212) PC	NO2 AVG STA 4 (212) EC	PERD ENDG (CST)
0100	219	25.3	.029	.014	NE		NE	0100
0200	213	25.0	.002	.002	NE	.001-	CL	0200
0300	207	24.8	.003	.002	NE	.002-	NI	0300
0400	205	26.2	.003	.002	NE	.001-	CL	0400
0500	203	25.8	.003	.002	NE	.001-	CL	0500
0600	198	25.3	.003	.001	NE	.001-	CL	0600
0700	196	24.5	.002	.002	NE	.001-	CL	0700
0800	195	24.9	.003	.002	NE	.001-	CL	0800
0900	198	23.3	.005	.002	NE	.001-	CL	0900
1000	201	24.1	.014	.004	NE	.001	IF	1000
1100	201	23.0	.006	.003	NE		NE	1100
1200	202	23.7	.007	.004	NE		NE	1200
1300	205	27.1	.012	.007	NE		NE	1300
1400	201	25.4	.007	.006	NE	.001-	CL	1400
1500	199	26.4	.007	.006	NE	.001-	CL	1500
1600	200	28.8	.007	.006	NE	.001-	CL	1600
1700	196	23.0	.006	.005	NE	.001-	CL	1700
1800	189	21.2	.006	.004	NE	.001-	CL	1800
1900	191	26.2	.004	.003	NE	.001-	CL	1900
2000	197	28.7	.003	.002	NE	.001-	CL	2000
2100	196	25.7	.004	.002	NE	.001-	CL	2100
2200	198	24.7	.003	.002	NE	.001-	CL	2200
2300	200	27.1	.003	.002	NE	.001-	CL	2300
2400	202	30.8	.004	.002	NE	.001-	CL	2400
AVRG	200	25.4		.003	LR		LR	AVRG

PERD ENDG (CST)	SO2 PEAK STA 7 (067) AG	SO2 AVG STA 7 (247) BG	NOX AVG STA 7 (247) VG	NO AVG STA 7 (247) PG	NO2 AVG STA 7 (247) EG	OZONE AVG STA 7 (247) GG	PERD ENDG (CST)
0100	.218	.144	.119	.079	.040	.001-	0100
0200	.301	.131	.107	.073	.034	.001	0200
0300	.160	.060	.075	.045	.030	.004	0300
0400	.313	.096	.042	.019	.023	.009	0400
0500	.177	.055	.034	.014	.020	.010	0500
0600	.164	.059	.023	.007	.016	.012	0600
0700	.088	.038	.050	.027	.023	.007	0700
0800	.049	.019	.047	.023	.024	.006	0800
0900	.544	.172	.014	.003	.011	.019	0900
1000	.635	.216	.009	.003	.006	.030	1000
1100	.200	.070	.011	.004	.007	.042	1100
1200	.138	.042	.011	.004	.007	.052	1200
1300	.136	.035	.011	.004	.007	.072	1300
1400	.112	.026	.012	.003	.009	.087	1400
1500	.386	.079	.010	.003	.007	.087	1500
1600	.643	.278	.014	.003	.011	.079	1600
1700	.399	.208	.013	.002	.011	.076	1700
1800	.104	.034	.009	.002	.007	.072	1800
1900	.230	.044	.011	.001	.010	.070	1900
2000	.703	.415	.016	.001	.015	.059	2000
2100	.320	.099	.007		.007	.055	2100
2200	.085	.022	.034	.011	.023	.035	2200
2300	.132	.071	.046	.009	.037	.020	2300
2400	.354	.118	.021	.001	.020	.037	2400
AVRG		.105	.031	.014	.016	.039	AVRG

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ALLEN STEAM PLANT
STA 66 11
00833S 11/30/80 (NOVA)

TENNESSEE VALLEY AUTHORITY
AMBIENT AIR CONCENTRATIONS (PPM)

PRINT-DATE 12/24/80
VALIDATED

PERD ENDG (CST)	SO2 PEAK STA 5 (136) AE	SO2 AVG STA 5 (316) BE	NOX AVG STA 5 (316) VE	NO AVG STA 5 (316) PE	NO2 AVG STA 5 (316) EE	SO2 PEAK STA 3 (232) BC	SO2 AVG STA 3 (032) BC	NOX AVG STA 3 (032) VC	NO AVG STA 3 (032) PC	NO2 AVG STA 3 (032) EC	PERD ENDG (CST)
0100	.001		.012	.002-	.014		.001-	.005		.005	0100
0200		.002-	.008	.001-	.009	.001		.004	.001	.003	0200
0300		.002-	.010	.001-	.011		.002-	.005	.001	.004	0300
0400		.001-		.002-	.002		.002-	.007		.007	0400
0500		.001-		.002-	.002		.003-	.011	.001	.010	0500
0600			.001	.001-	.002		.003-	.009	.001	.008	0600
0700	.001			.001-	.001		.002-	.010	.001	.009	0700
0800	.001		.002	.001-	.003		.002-	.006	.002	.004	0800
0900	.008	.002	.001	.001-	.002		.001-	.009	.004	.005	0900
1000	.004	.002	.005		.005			.005	.002	.003	1000
1100	.003	.001	.003	.001-	.004	.001		.005	.002	.003	1100
1200	.004	.002	.004	.001-	.005	.002	.001	.006	.002	.004	1200
1300	.004	.003	.006	.002-	.008	.003	.002	.007	.004	.003	1300
1400	.006	.004	.007	.001-	.008	.005	.003	.006	.005	.001	1400
1500	.006	.005	.008	.002-	.010	.005	.004	.006	.005	.001	1500
1600	.007	.005	.005	.002-	.007	.004	.004	.005	.004	.001	1600
1700	.006	.005	.003	.001-	.004	.004	.004	.005	.003	.002	1700
1800	.004	.004	.003	.002-	.005	.003	.003	.005	.002	.003	1800
1900	.003	.003	.002	.002-	.004	.003	.002	.004	.002	.002	1900
2000	.003	.002	.003	.003-	.006	.002	.001	.003	.001	.002	2000
2100	.003	.002		.002-	.002	.006	.002	.003	.001	.002	2100
2200	.003	.002	.001	.003-	.004	.004	.003	.003	.001	.002	2200
2300	.003	.002	.001	.002-	.003	.003	.002	.003	.001	.002	2300
2400	.005	.003	.007	.001-	.008	.004	.003	.004	.001	.003	2400
AVRG		.001	.003	.001-	.005			.005	.002	.003	AVRG

PERD ENDG (CST)	SO2 PEAK STA 6 (312) AF	SO2 AVG STA 6 (132) BF
0100	NE	NE
0200	NE	NE
0300	NE	NE
0400	NE	NE
0500	NE	NE
0600	NE	NE
0700	NE	NE
0800	NE	NE
0900	NE	NE
1000	NE	NE
1100	NE	NE
1200	NE	NE
1300	NE	NE
1400	NE	NE
1500	NE	NE
1600	NE	NE
1700	NE	NE
1800	NE	NE
1900	NE	NE
2000	NE	NE
2100	NE	NE
2200	NE	NE
2300	NE	NE
2400	NE	NE
AVRG		LR

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ALLEN STEAM PLANT — TENNESSEE VALLEY AUTHORITY — PRINT-DATE 12/24/80
STA 66 11 — AMBIENT AIR CONCENTRATIONS (PPM) — VALIDATED
801336 12/01/80 (NCVA)

PERD ENDG (CST)	PREV WD 0188	WIND SPEED 0188	SO2 PEAK STA 4 (032) AD	SO2 AVG STA 4 (212) BC	NOX AVG STA 4 (212) VC	NO AVG STA 4 (212) PD	NO2 AVG STA 4 (212) EC	PERD ENDG (CST)
0100	201	31.2	.004	.003	NE		NE	0100
0200	201	29.5	.006	.005	NE	.001-	CL	0200
0300	201	29.5	.006	.004	NE	.001-	CL	0300
0400	200	28.6	.006	.004	NE		NE	0400
0500	200	27.4	.005	.004	NE	.001-	CL	0500
0600	199	28.0	.004	.004	NE	.001-	CL	0600
0700	196	28.9	.004	.003	NE	.001-	CL	0700
0800	198	27.0	.004	.003	NE	.001-	CL	0800
0900	195	26.7	.004	.003	NE		NE	0900
1000	190	21.2	.004	.003	NE		NE	1000
1100	193	21.7	.004	.003	NE		NE	1100
1200	197	26.4	.004	.003	NE		NE	1200
1300	196	28.0	.003	.003	NE		NE	1300
1400	202	30.8	.004	.003	NE		NE	1400
1500	199	28.3	.006	.003	NE		NE	1500
1600	191	18.9	.004	.003	NE		NE	1600
1700	185	18.7	.003	.003	NE	.001-	CL	1700
1800	185	20.7	.003	.002	NE	.001-	CL	1800
1900	178	22.3	.006	.003	NE	.001-	CL	1900
2000	183	20.8	.004	.002	NE		NE	2000
2100	191	20.6	.003	.002	NE	.001-	CL	2100
2200	202	22.6	.004	.003	NE		NE	2200
2300	204	25.9	.010	.006	NE	.001-	CL	2300
2400	201	30.3	.003	.002	NE		NE	2400
AVRG	195	25.5		.003	LR		LR	AVRG

PERD ENDG (CST)	SO2 PEAK STA 7 (067) AG	SO2 AVG STA 7 (247) BG	NOX AVG STA 7 (247) VG	NO AVG STA 7 (247) PG	NO2 AVG STA 7 (247) EG	OZONE AVG STA 7 (247) GG	PERD ENDG (CST)
0100	.259	.098	.012	.001	.011	.057	0100
0200	.215	.113	.013	.001	.012	.047	0200
0300	.198	.066	.012	.001	.011	.047	0300
0400	.232	.081	.011	.001	.010	.047	0400
0500	.581	.275	.015	.001	.014	.042	0500
0600	.547	.369	.018		.018	.037	0600
0700	.395	.161	.013	.001-	.014	.039	0700
0800	.024	.004	.060	.014	.046	.013	0800
0900	.036	.011	.037	.004	.033	.026	0900
1000	.257	.068	.012	.001-	.013	.043	1000
1100	.363	.119	.012		.012	.046	1100
1200	.453	.208	.012		.012	.044	1200
1300	.559	.280	.014	.001	.013	.047	1300
1400	.248	.071	.012	.001	.011	.053	1400
1500	.456	.209	.015	.002	.013	.051	1500
1600	.435	.092	.011		.011	.053	1600
1700	.074	.031	.012		.012	.052	1700
1800	.057	.024	.012	.001-	.013	.051	1800
1900	.020	.009	.029	.001-	.030	.038	1900
2000	.048	.028	.018	.001-	.019	.046	2000
2100	.200	.078	.009	.001-	.010	.054	2100
2200	.485	.116	.011	.001-	.012	.053	2200
2300	.076	.028	.011	.001	.010	.053	2300
2400	.103	.050	.011	.002	.009	.059	2400
AVRG		.107	.016	.001	.015	.045	AVRG

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ALLEN STEAM PLANT — TENNESSEE VALLEY AUTHORITY — PRINT-DATE 12/24/80
STA 66 11 — AMBIENT AIR CONCENTRATIONS (PPM) — VALIDATED
80:336 12/01/80 (NCVA)

PERD ENDG (CST)	SO2 PEAK STA 5 (136) AE	SO2 AVG STA 5 (316) BE	NOX AVG STA 5 (316) VE	NO AVG STA 5 (316) PE	NO2 AVG STA 5 (316) EE	SO2 PEAK STA 3 (212) AC	SO2 AVG STA 3 (032) BC	NOX AVG STA 3 (032) VC	NO AVG STA 3 (032) PC	NO2 AVG STA 3 (032) EC	PERD ENDG (CST)
0100	.005	.004	.006	.001-	.007	.004	.003	.004	.001	.003	0100
0200	.002	.001	.007	.001-	.008	.004	.003	.005	.001	.004	0200
0300	.002	.001	.007	.002-	.009	.003	.002	.005	.001	.004	0300
0400	.002	.001	.007	.001-	.008	.002	.001	.005	.001	.004	0400
0500	.002	.001	.007	.002-	.009	.001		.005	.001	.004	0500
0600	.002	.001	.008	.002-	.010	.001		.005	.001	.004	0600
0700	.002	.001	.004	.002-	.006	.001		.005	.001	.004	0700
0800	.002	.001	.003	.001-	.004	.001		.006	.002	.004	0800
0900	.002	.001	.004	.001-	.005	.001		.006	.002	.004	0900
1000	.004	.001	.003	.001-	.004	.001		.005	.001	.004	1000
1100	.002	.001	.003	.002-	.005			.005	.001	.004	1100
1200	.002		.003	.001-	.004	.001		.005	.002	.003	1200
1300	.002		.001	.001-	.002	.001		.004	.002	.002	1300
1400	.002	.001	.002	.002-	.004	.001		.005	.004	.001	1400
1500	.002	.001	.002	.001-	.003	.001		.005	.004	.001	1500
1600	.002		.001	.003-	.004	.001		.006	.004	.002	1600
1700	.002		.001	.002-	.003	.002	.001	.007	.003	.004	1700
1800	.001		.001	.003-	.004	.002	.001	.009	.003	.006	1800
1900	.002		.002	.002-	.004	.002	.001	.005	.002	.003	1900
2000	.001		.002	.002-	.004	.002	.001	.006	.002	.004	2000
2100	.001			.002-	.002	.002	.001	.008	.002	.006	2100
2200	.001		.003	.002-	.005	.002	.001	.007	.002	.005	2200
2300	.002		.001	.003-	.004	.001	.001	.005	.002	.003	2300
2400	.001		.003	.002-	.005	.001	.001	.005	.002	.003	2400
AVRG			.003	.001-	.005			.005	.002	.003	AVRG

PERD ENDG (CST)	SO2 PEAK STA 6 (312) AF	SO2 AVG STA 6 (132) BF	PERD ENDG (CST)
0100	NE	NE	0100
0200	NE	NE	0200
0300	NE	NE	0300
0400	NE	NE	0400
0500	NE	NE	0500
0600	NE	NE	0600
0700	NE	NE	0700
0800	NE	NE	0800
0900	NE	NE	0900
1000	NE	NE	1000
1100	NE	NE	1100
1200	NE	NE	1200
1300	NE	NE	1300
1400	NE	NE	1400
1500	NE	NE	1500
1600	NE	NE	1600
1700	NE	NE	1700
1800	NE	NE	1800
1900	NE	NE	1900
2000	NE	NE	2000
2100	NE	NE	2100
2200	NE	NE	2200
2300	NE	NE	2300
2400	NE	NE	2400
AVRG		LP	AVRG

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Table A-3

AMBIENT AIR QUALITY DATA

December 17-18, 1980

ALLEN STEAM PLANT — TENNESSEE VALLEY AUTHORITY — PRINT-DATE 01/28/81
STA 64 11 — AMBIENT AIR CONCENTRATIONS (PPM) — VALIDATED
8G#352 12/17/80 (NCVA)

PERD ENDG (CST)	PREV WD 11CM 0188	WIND SPEED 11OM 01EB	SO2 PEAK STA 4 (032) AC	SO2 AVG STA 4 (212) BD	NOX AVG STA 4 (212) VD	NO AVG STA 4 (212) PD	NO2 AVG STA 4 (212) ED	PERD ENDG (CST)
0100	22	13.8	.017	.015	LR	LR	LR	0100
0200	34	12.6	.014	.012	LR	LR	LR	0200
0300	35	10.9	.011	.010	LR	LR	LR	0300
0400	40	10.1	.010	.007	LR	LR	LR	0400
0500	50	9.5	.012	.008	LR	LR	LR	0500
0600	47	7.9	.007	.006	LR	LR	LR	0600
0700	58	8.3	.006	.004	LR	LR	LR	0700
0800	36	4.5	.004	.002	LR	LR	LR	0800
0900	21	1.7	.010	.004	LR	LR	LR	0900
1000	222	1.9	.042	.018	LR	LR	LR	1000
1100	289	2.4	.134	.081	LR	LR	LR	1100
1200	269	4.2	.125	.080	LR	LR	LR	1200
1300	219	6.0	.670	.156	LR	LR	LR	1300
1400	216	7.8	.838	.276	LR	LR	LR	1400
1500	213	8.5	.361	.110	LR	LR	LR	1500
1600	203	10.9	.322	.042	LR	LR	LR	1600
1700	201	14.8	.004	.002	LR	LR	LR	1700
1800	202	18.1	.002	.001	LR	LR	LR	1800
1900	202	20.5	.002	.001	LR	LR	LR	1900
2000	202	23.2	.003	.002	LR	LR	LR	2000
2100	200	25.0	.003	.002	LR	LR	LR	2100
2200	204	27.7	.003	.002	LR	LR	LR	2200
2300	207	28.1	.004	.003	LR	LR	LR	2300
2400	207	26.6	.005	.004	LR	LR	LR	2400
AVRG	149	12.7		.035	LR	LR	LR	AVRG

PERD ENDG (CST)	SO2 PEAK STA 7 (067) AG	SO2 AVG STA 7 (247) BG	NOX AVG STA 7 (247) VG	NO AVG STA 7 (247) PG	NO2 AVG STA 7 (247) EG	OZONE AVG STA 7 (247) GG	PERD ENDG (CST)
0100	.036	.006	.023	.006	.017	.001	0100
0200	.013	.012	.037	.018	.019	.001	0200
0300	.012	.010	.035	.017	.018	.001	0300
0400	.016	.012	.042	.024	.018	.001	0400
0500	.015	.012	.041	.023	.018	.001	0500
0600	.013	.009	.045	.026	.019	.001	0600
0700	.010	.008	.062	.044	.018	.001	0700
0800	.015	.013	.108	.085	.023	.001	0800
0900	NE	NE	NE	NE	LR	NE	0900
1000	NE	NE	NE	NE	LR	NE	1000
1100	NE	NE	NE	NE	LR	NE	1100
1200	NE	.038	NE	NE	LR	NE	1200
1300	NE	.035	NE	NE	LR	NE	1300
1400	NE	.113	NE	NE	LR	NE	1400
1500	.080	.022	.022	.005	.017	.021	1500
1600	.121	.011	.003	.001	.006	.028	1600
1700	.281	.074	.008	.001	.011	.021	1700
1800	.279	.115	.009	.001	.013	.018	1800
1900	.563	.265	.010	.001	.013	.014	1900
2000	.560	.311	.011	.001	.014	.013	2000
2100	.671	.330	.011	.001	.014	.013	2100
2200	.990	.503	.012	.001	.015	.012	2200
2300	.144	.049	.002	.001	.006	.021	2300
2400	.082	.043		.001	.005	.019	2400
AVRG		.094	.026	.014	.014	.010	AVRG

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ALLEN STEAM PLANT
STA 66 11
BC:352 12/17/80 (NOVA)

TENNESSEE VALLEY AUTHORITY
AMBIENT AIR CONCENTRATIONS (PPM)

PRINT-DATE 01/28/81
VALIDATED

PERD ENDG (CST)	SO2 PEAK STA 5 (136) AE	SO2 AVG STA 5 (316) BE	NOX AVG STA 5 (316) VE	NO AVG STA 5 (316) PE	NO2 AVG STA 5 (316) EE	SO2 PEAK STA 3 (212) AC	SO2 AVG STA 3 (032) BC	NOX AVG STA 3 (032) VC	NO AVG STA 3 (032) PC	NO2 AVG STA 3 (032) EC	PERD ENDG (CST)
0100	.011	.010	.027	.007	.020	.016	.015	.024	.003	.021	0100
0200	.011	.011	.028	.007	.021	.016	.014	.023	.001	.022	0200
0300	.010	.007	.025	.006	.019	.013	.010	.025	.003	.022	0300
0400	.009	.007	.033	.013	.020	.010	.008	.030	.007	.023	0400
0500	.050	.017	.035	.014	.021	.014	.009	.031	.008	.023	0500
0600	.038	.016	.035	.014	.021	.010	.008	.032	.009	.023	0600
0700	.010	.006	.038	.018	.020	.008	.007	.037	.014	.023	0700
0800	.009	.006	.045	.026	.019	.009	.007	.046	.024	.022	0800
0900	.022	.010	.059	.038	.021	.019	.009	.037	.019	.018	0900
1000	.023	.020	.072	.042	.030	.076	.035	.050	.026	.024	1000
1100	.022	.017	.057	.026	.031	.034	.024	.041	.018	.023	1100
1200	.044	.023	.046	.017	.029	NE	NE	NE	NE	LR	1200
1300	.140	.097	.085	.047	.038	NE	NE	NE	NE	LR	1300
1400	.145	.081	.063	.030	.033	.114	.040	.043	.018	.025	1400
1500	.019	.007	.013	.004	.009	.009	.001	.013	.001	.012	1500
1600	.006	.004	.011	.002	.009		.001	.011	.001	.011	1600
1700	.006	.005	.015	.001	.014	.001	.001	.009	.001	.010	1700
1800	.006	.006	.015	.001	.014	.003	.002	.009	.001	.010	1800
1900	.008	.006	.019	.001	.019	.006	.004	.009	.001	.010	1900
2000	.007	.007	.017	.001	.017	.007	.006	.008	.001	.009	2000
2100	.007	.006	.011	.001	.011	.007	.006	.007	.001	.009	2100
2200	.007	.006	.011	.001	.012	.008	.007	.006	.001	.008	2200
2300	.006	.005	.006	.001	.007	.007	.007	.005	.001	.007	2300
2400	.007	.005	.005	.001	.006	.008	.007	.005	.001	.007	2400
AVRG		.016	.032	.013	.019		.010	.022	.007	.016	AVRG

PERD ENDG (CST)	SO2 PEAK STA 6 (312) AF	SO2 AVG STA 6 (132) BF
0100	.020	.018
0200	.010	.008
0300	.008	.005
0400	.007	.005
0500	.006	.004
0600	.006	.005
0700	.006	.005
0800	.005	.004
0900	.007	.004
1000	NE	NE
1100	NE	NE
1200	.061	.046
1300	.103	.054
1400	.062	.040
1500	.025	.017
1600	.010	.009
1700	.009	.007
1800	.010	.007
1900	.009	.006
2000	.009	.007
2100	.008	.006
2200	.007	.005
2300	.007	.005
2400	.007	.004
AVRG		.012

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ALLEN STEAM PLANT — TENNESSEE VALLEY AUTHORITY — PRINT-DATE 01/28/81
STA 60 11 — AMBIENT AIR CONCENTRATIONS (PPM) — VALIDATED
80:353 12/18/80 (NOVA)

PERD ENDG (CST)	PREV WD 110M Q188	WIND SPEED 110M Q1EB	SO2 PEAK STA 4 (032) AC	SO2 AVG STA 4 (212) BD	NOX AVG STA 4 (212) VD	NO AVG STA 4 (212) PD	NO2 AVG STA 4 (212) ED	PERD ENDG (CST)
0100	207	26.2	.005	.004	LR	LR	LR	0100
0200	205	24.7	.006	.005	LR	LR	LR	0200
0300	205	27.7	.006	.005	LR	LR	LR	0300
0400	203	29.7	.007	.005	LR	LR	LR	0400
0500	202	28.4	.007	.006	LR	LR	LR	0500
0600	202	27.8	.006	.005	LR	LR	LR	0600
0700	199	25.6	.006	.005	LR	LR	LR	0700
0800	198	24.4	.006	.005	LR	LR	LR	0800
0900	200	27.0	.005	.005	LR	LR	LR	0900
1000	204	25.5	.005	.005	LR	LR	LR	1000
1100	208	26.3	.006	.005	LR	LR	LR	1100
1200	207	28.0	.006	.005	LR	LR	LR	1200
1300	209	28.7	.007	.005	LR	LR	LR	1300
1400	205	28.5	.005	.005	LR	LR	LR	1400
1500	204	27.0	.006	.005	LR	LR	LR	1500
1600	203	27.8	.006	.004	LR	LR	LR	1600
1700	199	25.7	.004	.004	LR	LR	LR	1700
1800	196	22.2	.004	.004	LR	LR	LR	1800
1900	195	22.9	.004	.004	LR	LR	LR	1900
2000	200	22.6	.006	.004	LR	LR	LR	2000
2100	212	15.5	.010	.006	LR	LR	LR	2100
2200	205	17.4	.008	.005	LR	LR	LR	2200
2300	202	13.6	.013	.007	LR	LR	LR	2300
2400	32	15.6	.021	.010	LR	LR	LR	2400
AVRG	195	24.6		.005	LR	LR	LR	AVRG

PERD ENDG (CST)	SO2 PEAK STA 7 (067) AG	SO2 AVG STA 7 (247) BG	NOX AVG STA 7 (247) VG	NO AVG STA 7 (247) PG	NO2 AVG STA 7 (247) EG	OZONE AVG STA 7 (247) GG	PERD ENDG (CST)
0100	.096	.046	.001	.001	.006	.018	0100
0200	.085	.043	.004	.001	.008	.014	0200
0300	.063	.036	.003	.001	.007	.015	0300
0400	.098	.042	.007	.001	.010	.013	0400
0500	.139	.066	.003	.001	.008	.016	0500
0600	.385	.121	.007	.001	.010	.014	0600
0700	.659	.242	.012	.001	.015	.010	0700
0800	.325	.134	.013	.001	.015	.011	0800
0900	.609	.305	.015	.001	.015	.017	0900
1000	.265	.035	.004	.001	.006	.028	1000
1100	.071	.020	.004	.001	.006	.030	1100
1200	.106	.027	.003	.001	.005	.037	1200
1300	.095	.018	.004	.001	.006	.040	1300
1400	.084	.024	.002	.001	.004	.044	1400
1500	.104	.021	.003	.001	.005	.047	1500
1600	NE	.051	.002	.001	.005	.048	1600
1700	NE	NE	NE	NE	LR	LR	1700
1800	.921	.486	LR	LR	LR	LR	1800
1900	.649	.171	.010	.001	.014	LR	1900
2000	.553	.510	.015	.001	.018	LR	2000
2100	.143	.059	.006	.001	.009	LR	2100
2200	.176	.018	.006	.001	.009	LR	2200
2300	.101	.020	.009	.001	.008	LR	2300
2400	.019	.010	.024	.004	.020	LR	2400
AVRG		.108	.008	.001	.010	.025	AVRG

BEST DOCUMENT AVAILABLE

ALLEN STEAM PLANT
STA 66 11
EC:353 12/18/80 (AGVA)

TENNESSEE VALLEY AUTHORITY
AMBIENT AIR CONCENTRATIONS (PPM)

PRINT-DATE 01/28/81
VALIDATED

PERD ENDG (CST)	SO2 PEAK STA 5 (136) AE	SO2 AVG STA 5 (316) BE	NOX AVG STA 5 (316) VE	NO AVG STA 5 (316) PE	NO2 AVG STA 5 (316) EE	SO2 PEAK STA 3 (212) AC	SO2 AVG STA 3 (032) BC	NOX AVG STA 3 (032) VC	NO AVG STA 3 (032) PC	NO2 AVG STA 3 (032) EC	PERD ENDG (CST)
0100	.005	.005	.006	.001	.006	.008	.008	.005	.001	.007	0100
0200	.002	.001	.008	.001	.009	.004	.023	.009	.001	.011	0200
0300	.003	.002	.006	.001	.007	.003	.001	.007	.001	.009	0300
0400	.004	.003	.009	.001	.009	.002	.002	.007	.001	.009	0400
0500	.003	.003	.012	.001	.013	.003	.002	.007	.001	.009	0500
0600	.003	.003	.014	.001	.015	.003	.002	.007	.001	.009	0600
0700	.027	.003	.011	.001	.011	.004	.003	.007	.001	.009	0700
0800	.002	.001	.009	.001	.010	.004	.003	.007	.001	.008	0800
0900	NE	NE	NE	NE	.001	.004	.003	.008	.001	.009	0900
1000	NE	NE	NE	NE	.001	.004	.003	.007	.001	.007	1000
1100	NE	NE	NE	NE	.001	.005	.004	.008	.001	.008	1100
1200		LR	.009	.001	.009	.005	.004	.007	.001	.008	1200
1300	.047	LR	.009	.001	.008	.005	.004	.006	.001	.007	1300
1400	.006	LR	.008	.001	.008	.006	.004	.006	.001	.007	1400
1500	.009	LR	.007	.001	.008	.007	.006	.006	.001	.006	1500
1600	.011	LR	.006	.001	.008	.006	.005	.005	.001	.005	1600
1700	.012	LR	.006	.001	.008	.005	.004	.004	.001	.005	1700
1800	.013	LR	.005	.001	.007	.005	.004	.003	.001	.003	1800
1900	.013	LR	.004	.001	.004	.005	.004	.004	.001	.005	1900
2000	.012	LR	.006	.001	.008	.005	.004	.004	.001	.006	2000
2100	.012	LR	.008	.001	.008	.004	.004	.005	.001	.006	2100
2200	.011	LR	.007	.001	.008	.004	.004	.004	.001	.004	2200
2300	.012	LR	.017	.001	.018	.017	.006	.013	.001	.015	2300
2400	.012	LR	.023	.001	.022	.049	.022	.026	.003	.023	2400
AVRG		LR	.009	.001	.008		.004	.007	.001	.008	AVRG

PERD ENDG (CST)	SO2 PEAK STA 6 (312) AF	SO2 AVG STA 6 (132) BF	PERD ENDG (CST)
0100	.007	.006	0100
0200	.006	.003	0200
0300	.005	.003	0300
0400	.005	.004	0400
0500	.006	.004	0500
0600	.006	.004	0600
0700	.006	.004	0700
0800	.006	.004	0800
0900	.007	.005	0900
1000	.007	.005	1000
1100	.008	.006	1100
1200	.009	.006	1200
1300	.008	.006	1300
1400	.009	.006	1400
1500	.009	.007	1500
1600	.009	.007	1600
1700	.008	.006	1700
1800	.007	.005	1800
1900	.007	.005	1900
2000	.007	.005	2000
2100	.007	.005	2100
2200	.007	.005	2200
2300	.014	.008	2300
2400	.015	.011	2400
AVRG		.005	AVRG

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Table A-4

ACCURACY OF MEASUREMENT

(BASED ON "AS FOUND" CALIBRATIONS)

1. Calculate equation of straight line connecting two calibration points.

Date	Monitor Reading (x)	Calibrator Reading (y)	Equation
November 30-December 1, 1980	$x_1 = 0.238$ $x_2 = 0.825$	$y_1 = 0.217$ $y_2 = 0.862$	$y = 1.099\ x - 0.045$
December 17-18, 1980	$x_1 = 0.216$ $x_2 = 0.802$	$y_1 = 0.217$ $y_2 = 0.862$	$y = 1.101\ x - 0.021$
State of Tennessee Audit (February 10, 1981)	$x_1 = 0.063$ $x_2 = 0.172$	$y_1 = 0.074$ $y_2 = 0.183$	$y = 1.000\ x + 0.011$

2. Substitute actual monitor reading (24-hour average) into equation and determine probable ambient concentration.

Date	Monitor Reading (ppm)	Ambient Concentration (ppm)	
		TVA Calibration	Tennessee Audit
November 30-December 1, 1980	0.143	0.112	0.154
December 17-18, 1980	.144	.138	0.155

3. Calculate Monitor Error
   a. Determine difference subtract ambient concentration
   b. Calculate percent error (Difference divided by Ambient Concentration from monitor reading)

Date	Difference (ppm)		Error (%)	
	Test Calibration	Tennessee Audit	TVA Calibration	Tennessee Audit
November 30-December 1, 1980	0.031	-0.011	28	-8
December 17-18, 1980	0.006	-0.011	4	-8

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PHILIPS SO_2 MONITOR CALIBRATION REPORT

#4

LOCATION (PLANT) ALLEN
STATION NO. 7
MONITOR FULL SCALE 1.0 PPM
CURRENT CALIBRATION DATE 12-3-80
TIME OUT OF SERVICE 0830
TIME IN SERVICE 1315
CALIBRATED BY M.H
LAST CALIBRATION DATE 11-26-80

MONITOR LABS, MODEL 8500,
CALIBRATION S/N 460
LAST CALIBRATION DATE 10-14-80

	Sample Value (ppm)	As Found					As Left				
		Recorder (ppm)	Percent Error	HSDL Octal Count	HSDL (ppm)	Percent Error	Recorder (ppm)	Percent Error	HSDL Octal Count	HSDL (ppm)	Percent Error
Signal Zero	N/A	.038	N/A	23	0	N/A	.050	N/A	25	0	N/A
Recorder Zero	N/A	Line No. 3	N/A	N/A	N/A	N/A	Line No.	N/A	N/A	N/A	N/A
Sample 1	.217	.238	+9.68	402	.239	+10.13	.216	-0.46	353	.215	-0.92
Sample 2	.592						.593	+0.17	1144	.592	0
Sample 3	.862	.825	-4.29	1515	.826	-4.17	.855	-0.81	1552	.854	-0.92
Internal Source	—	.301	—	477	.300	—	.297	—	475	.297	—
Air Flow And Balance Measurements		Ref. Volts 725-775 MV	Measuring Cell 150-160 CC/Min		Chemical Intake 290-325 CC/Min		Ref. Volts 725-775 MV	Measuring Cell 150-160 CC/Min		Chemical Intake 290-325 CC/Min	
		750	140		285		750	150		295	

TELEMETRY COMMANDS CHECKED: ZERO (70) ✓ CALIBRATE (71) ✓ MEASURE (72) ✓ STATUS (01) ✓

REMARKS: Test Box Telemetry Octal Values: MUX PT 60 - 0000 MUX PT 61 - 0764 MUX PT 62 - 1750
7 day Cal.
Replace measure orifice - Scrub. Probe cap seals.
Balance amplifiers - Clean Ref. Ind. & Electrode.

TVA 11043 (WM-8-78)

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PHILIPS SO_2 MONITOR CALIBRATION REPORT

LOCATION (PLANT) ALLEN
STATION NO. 7
MONITOR FULL SCALE 0-1.0 PPM
CURRENT CALIBRATION DATE 12-23-80
TIME OUT OF SERVICE 1100 CST
TIME IN SERVICE
CALIBRATED BY INT.S.
LAST CALIBRATION DATE 12-17-80

MONITOR LABS, MODEL 8500,
CALIBRATION S/N 460
LAST CALIBRATION DATE 10-14-80

	Sample Value (ppm)	As Found					As Left				
		Recorder (ppm)	Percent Error	HSDL Octal Count	HSDL (ppm)	Percent Error	Recorder (ppm)	Percent Error	HSDL Octal Count	HSDL (ppm)	Percent Error
Signal Zero	N/A	.040	N/A	20	16 0	N/A	.050	N/A	41	33 0	N/A
Recorder Zero	N/A	Line No. 4	N/A	N/A	N/A	N/A	Line No. 3	N/A	N/A	N/A	N/A
Sample 1 15	.217	.210	-.46	347	.215	-.92	.220	+1.38	325	.320	+1.38
Sample 2 13	.592						.584	-1.35	1151	.584	-1.35
Sample 3 9	.962	.802	-6.96	1462	.802	-6.96	.856	-.70	1572	.857	-.58
Internal Source		.260		922	.258		.267		454	.267	
Air Flow And Balance Measurements		Ref. Volts 725-775 MV	Measuring Cell 150-160 CC/Min		Chemical Intake 290-325 CC/Min		Ref. Volts 725-775 MV	Measuring Cell 150-160 CC/Min		Chemical Intake 290-325 CC/Min	
		760	150		290		765	150		290	

TELEMETRY COMMANDS CHECKED: ZERO (70) ok CALIBRATE (71) ok MEASURE (72) ok STATUS (01) ok

REMARKS: Test Box Telemetry Octal Values: MUX PT 60 - 0000 MUX PT 61 - 0764 MUX PT 62 - 1750
7 DAY CAL.

TVA 11043 (WM-8-78)

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AUDIT OF AMBIENT MONITOR

Company or Agency TVA Allen

Site I.D. #7 44-2340-032 N01

Parameter SO_2 Q.A. Calibrator # 3

Inst. Model # Philips 9710 Q.A. Inst. Serial # 587

Inst. Serial # D 2425C Q.A. Calibrator Offset NA

Inst. Range 0-1 PPM Standard Reference 55-77 SRM

Zero Reading 10 DIV Q.A. Inspector R.L. Strong

PPM/DIV .005 Date 2/10/81

SAMPLE NUMBER	CALIBRATOR SETTING	AUDIT CONC. (PPM)	CHART RESPONSE	MONITOR READING (PPM)	% DIFF
1	ZERO AIR	0.000	10 DIV	0.000	
2	L-11.0	.074	22.5 DIV	.063	-14.9
3	L-4.5	.183	44.5 DIV	.172	-6.0
4	H-14.5	.186	44.6 DIV	.174	-6.5
5	H-6.3	.425	91.5 DIV	.408	-4.0
6	H-3.5	.831	172.5 DIV	.813	-2.3

Shelter ok

Sample Intake ok

Sample Line ok

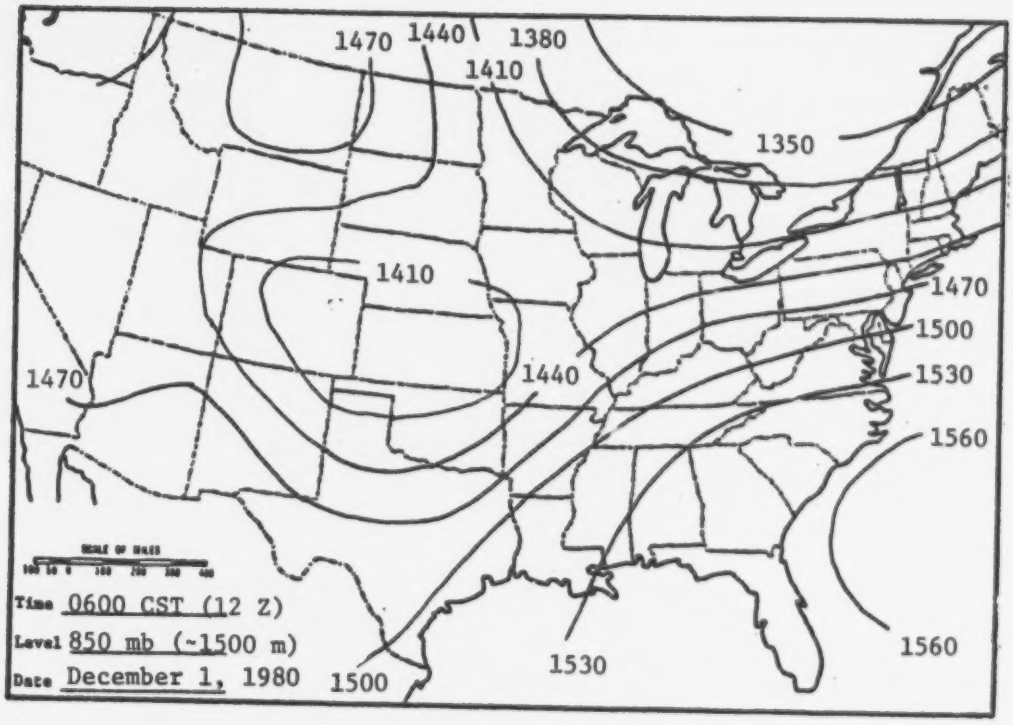
Filters ok

Comments: 8:30-10:30

TVA INJECTIONS: .215 read .200 (-7.0); .430 read .415 (-3.5)

APPENDIX B

Meteorological Data



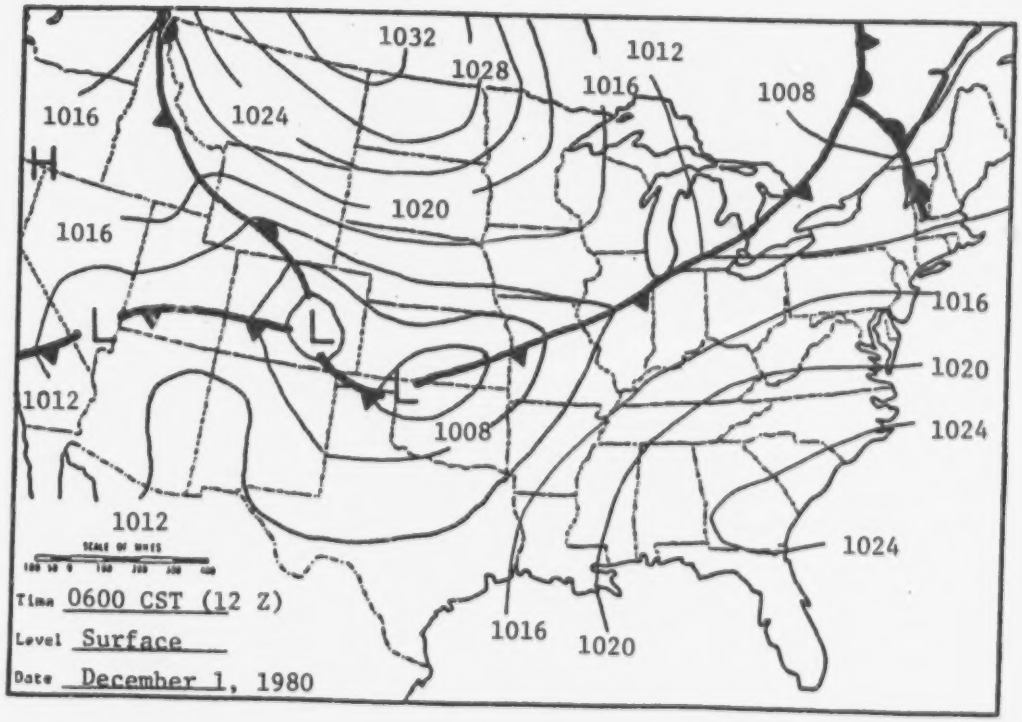


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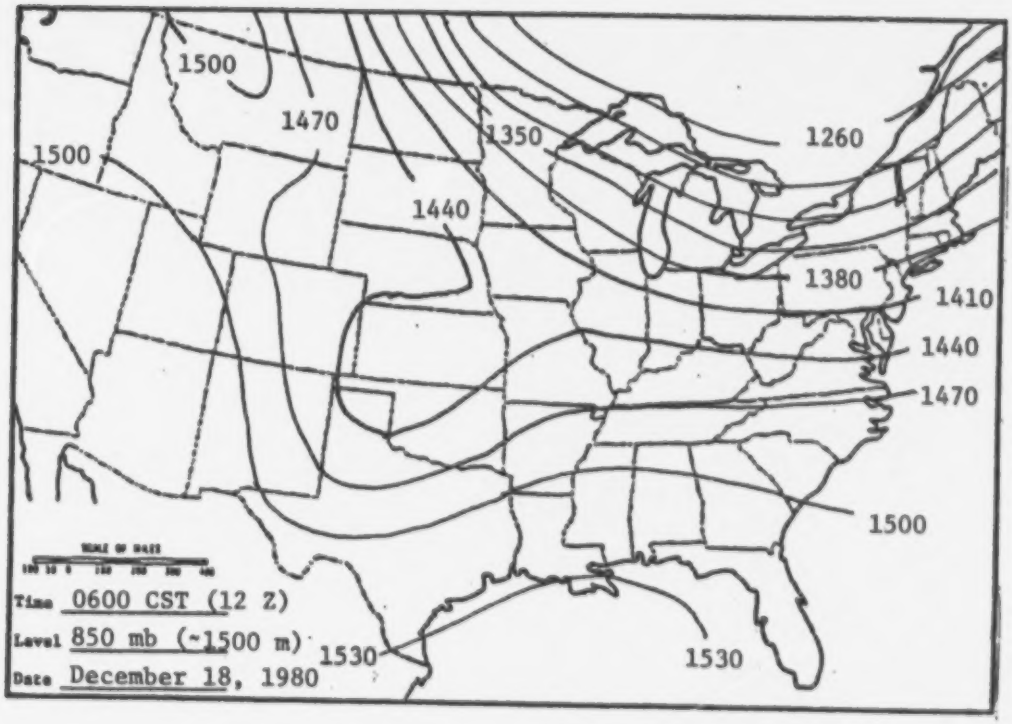
Figure B-1. SYNOPTIC WEATHER MAPS - DECEMBER 1, 1980



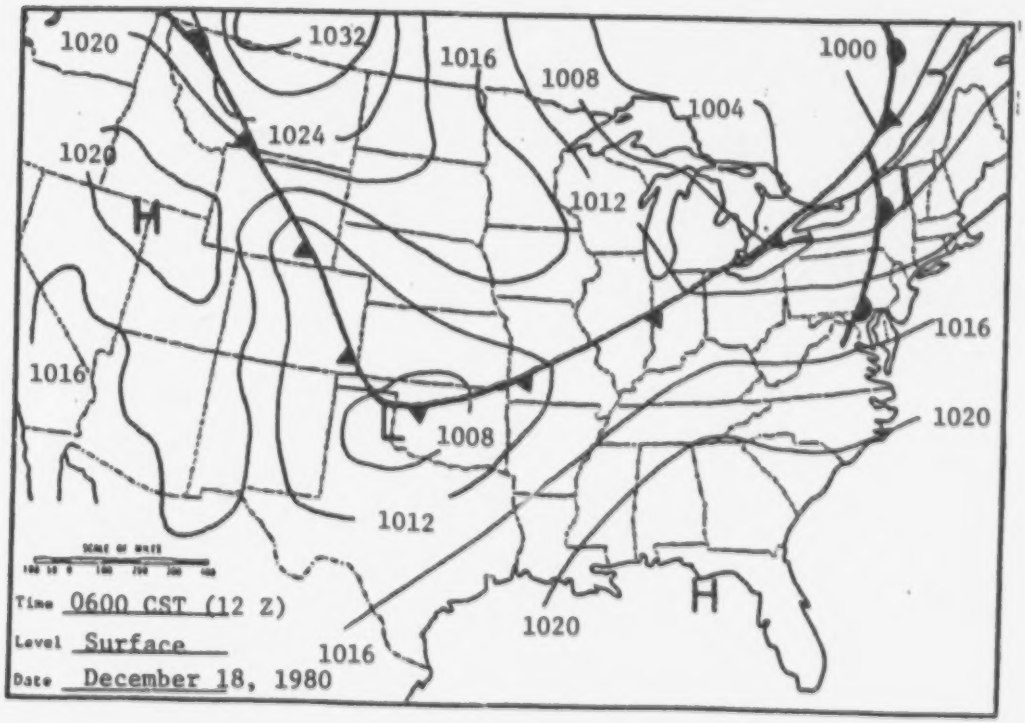


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Figure B-2. SYNOPTIC WEATHER MAPS - DECEMBER 18, 1980

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Table B-1

METEOROLOGICAL TOWER DATA

November 30-December 1, 1980

ALLEN STEAM PLANT
METEORLOGICAL TOWER DATA
NOVEMBER 30, 1980

HOUR ENDING (CDT)	110METER WINDS WIND SPEED (M/S)	110METER WINDS WIND DIRECTION (DEG)	110METER WINDS PERSISTANCE (%)	TEMP 110-METER (DEG C)	TEMP 10-METER (DEG C)	TEMP 1-METER (DEG C)
100	11.3	219	95	10.8	5.3	2.8
200	11.2	213	95	9.7	5.0	2.5
300	11.1	207	93	9.5	5.3	1.4
400	11.7	205	94	9.8	5.5	2.2
500	11.5	203	94	8.8	6.0	4.2
600	11.3	198	93	8.8	6.0	3.7
700	11.0	196	92	8.9	7.8	6.4
800	11.1	195	92	9.3	8.9	8.0
900	10.4	198	92	9.7	10.5	10.8
1000	10.8	201	92	10.6	12.0	12.6
1100	10.3	201	90	11.8	13.6	14.4
1200	10.6	202	91	13.0	15.0	15.8
1300	12.1	205	92	14.6	16.6	17.4
1400	11.4	201	90	15.3	17.2	17.8
1500	11.8	199	90	15.7	17.4	17.6
1600	12.9	200	93	15.9	16.9	16.9
1700	10.3	196	88	15.7	16.2	15.5
1800	9.5	189	85	15.3	15.6	14.7
1900	11.7	191	87	15.5	15.8	15.0
2000	12.8	197	92	15.9	15.8	14.9
2100	11.5	196	90	15.5	15.4	14.5
2200	11.0	198	92	14.8	13.5	12.6
2300	12.1	200	93	14.4	13.5	12.7
2400	13.8	202	93	13.5	13.4	12.7

* INDICATES LOST RECORDS

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ALLEN STEAM PLANT
METEOROLOGICAL TOWER DATA
DECEMBER 1, 1980

HOUR ENDING (CDT)	110METER WINDS WIND SPEED (M/S)	WIND DIRECTION (DEG)	PERSISTANCE (S)	TEMP 110-METER (DEG C)	TEMP 10-METER (DEG C)	TEMP 1-METER (DEG C)
100	13.9	201	94	12.5	12.5	11.9
200	13.2	201	94	12.3	12.1	11.5
300	13.2	201	94	11.7	11.7	11.1
400	12.8	200	93	11.0	11.0	10.4
500	12.2	200	92	10.9	11.1	10.5
600	12.5	199	93	10.5	10.8	10.2
700	12.5	196	91	10.7	11.1	10.6
800	12.1	198	91	11.5	12.0	11.6
900	11.9	195	86	12.4	13.2	13.2
1000	9.5	190	74	13.2	14.5	14.8
1100	9.7	193	79	14.4	16.0	16.4
1200	11.8	197	90	15.2	16.7	17.1
1300	12.5	196	87	16.4	18.1	18.5
1400	13.8	202	93	17.0	18.8	19.5
1500	12.7	199	91	17.2	18.4	18.4
1600	8.4	191	76	17.5	18.4	18.2
1700	8.4	185	79	17.4	18.1	17.6
1800	9.3	185	81	17.2	17.7	17.0
1900	10.0	178	79	17.2	17.7	17.1
2000	9.3	183	81	16.6	17.0	16.3
2100	9.2	191	89	16.4	16.7	16.0
2200	10.1	202	92	16.2	16.2	15.8
2300	11.6	204	94	15.7	15.9	15.7
2400	13.5	201	93	15.6	15.9	15.6

* INDICATES LOST RECORDS

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Table B-2

METEOROLOGICAL TOWER DATA

December 17-18, 1980

ALLEN STEAM PLANT
METEORLOGICAL TOWER DATA
DECEMBER 17, 1980

HOUR ENDING (CDT)	110METER WINDS WIND SPEED (M/S)	WIND DIRECTION (DEG)	PERSISTANCE (%)	TEMP 110-METER (DEG C)	TEMP 10-METER (DEG C)	TEMP 1-METER (DEG C)
100	6.2	22	100	1.4	1.7	0.9
200	5.6	34	100	1.1	1.1	0.3
300	4.9	35	100	0.7	0.8	-0.1
400	4.5	40	100	0.2	0.4	-0.5
500	4.2	50	99	0.0	0.4	-0.6
600	3.5	47	100	-0.3	0.0	-2.0
700	3.7	58	100	-0.5	-0.3	-2.0
800	2.0	36	52	-0.8	-1.1	-4.4
900	0.8	21	35	-0.8	-0.1	-0.5
1000	0.8	222	24	0.5	1.6	2.2
1100	1.1	289	25	2.0	3.3	4.0
1200	1.9	269	47	3.5	5.0	5.8
1300	2.7	219	44	4.6	6.3	7.1
1400	3.5	216	62	5.5	7.4	7.9
1500	3.8	213	63	5.9	7.5	8.0
1600	4.9	209	91	6.2	7.7	7.9
1700	6.6	201	100	6.5	7.2	6.7
1800	8.1	202	100	6.3	6.0	5.1
1900	9.2	202	100	6.0	5.1	4.2
2000	10.4	202	100	5.9	5.2	4.3
2100	11.2	200	100	5.9	5.3	4.6
2200	12.4	204	100	5.9	5.8	5.1
2300	12.6	207	100	5.5	5.3	4.7
2400	11.9	207	100	4.9	4.9	4.3

* INDICATES LOST RECORDS

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ALLEN STEAM PLANT
METEORLOGICAL TOWER DATA
DECEMBER 18, 1980

HOUR ENDING (CDT)	110METER WINDS WIND SPEED (M/S)	WIND DIRECTION (DEG)	PERSISTANCE (%)	TEMP 110-METER (DEG C)	TEMP 10-METER (DEG C)	TEMP 1-METER (DEG C)
100	11.7	207	100	4.8	4.6	4.0
200	11.0	205	100	4.6	4.6	4.0
300	12.4	205	100	4.9	4.6	4.1
400	13.3	203	100	5.5	5.1	4.5
500	12.7	202	100	5.7	5.7	5.1
600	12.4	202	100	5.5	5.4	4.9
700	11.4	199	99	5.8	5.8	5.2
800	10.9	198	99	6.6	6.7	6.2
900	12.1	200	98	7.6	8.7	8.9
1000	11.4	204	98	8.0	9.7	10.4
1100	11.8	208	99	10.0	11.9	12.8
1200	12.5	207	98	11.8	13.8	14.7
1300	12.8	209	99	13.4	15.5	16.2
1400	12.7	205	99	14.8	16.7	17.2
1500	12.1	204	99	15.5	17.1	17.2
1600	12.4	203	100	15.9	17.1	17.0
1700	11.5	199	99	16.0	16.3	15.7
1800	9.9	196	100	15.9	15.6	14.7
1900	10.2	195	100	15.8	15.2	13.9
2000	10.1	200	100	15.7	14.2	13.0
2100	6.9	212	100	14.6	12.8	7.9
2200	7.8	205	100	13.0	12.5	5.6
2300	6.1	202	30	13.1	12.5	10.5
2400	8.8	32	84	7.8	8.9	8.8

* INDICATES LOST RECORDS

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APPENDIX C

SO_2 Emission Data

Table C-1

SULFUR DIOXIDE EMISSION INVENTORY DATA

FOR SO_2 POINT SOURCES WITHIN 10 km

RADIUS OF MONITOR 7[a]

Source Name	UTM Source Location (km)[b] Easting	Northing	SO_2 Emission Rate (g/sec) Allowable	Estimated Actual
Allen Steam Plant (TVA)	760.0	3884.7	15,737.3	3043.9
B & M Asphalt Company	765.0	3889.5	0.2	.1
Buckman Labs, Inc.	227.3	3895.9	22.0	.0
Delta Refinery	766.0	3886.3	201.2	615.2
Firestone Tire & Rubber	770.8	3876.5	0	1.4
Layne Bowler	773.7	3896.0	6.6	0
Kimberly-Clark Corp.	767.0	3877.5	247.2	1.2
MPH Furniture Company	771.2	3890.8	6.7	.2
Refined Metals Corp.	766.9	3886.4	0	9.4
Joseph E. Seagrams	767.4	3890.3	15.5	0
Joseph E. Seagrams	762.7	3886.1	1.5	0
Prest Mfg. Company	769.5	3896.9	0	0.5
Ralston Purina	784.1	3880.5	62.7	3.2
Sharp Lumber Company	770.1	3897.1	1.8	0
Trumball Asphalt Company	770.8	3897.0	12.8	0.4
Tennessee Fabricating	770.3	3886.0	0	0.1
Wabash, Inc.	767.7	3889.3	3.8	0
Methodist Hospital	772.0	3892.1	NA	0
Anderson-Tully	222.7	3896.7	4.5	0.1
Allied Mills, Inc.	225.8	3888.5	8.8	0
Allied Mills, Inc.	227.5	3888.8	6.6	0
Kellogg Company	227.5	3887.5	33.2	0
Coreill, Inc.	763.7	3887.2	46.0	.7
Desota Hardwood Flooring	771.2	3890.8	1.6	.3

a. Tennessee only: from State of Tennessee source emission inventory.
b. Easting coordinates less than 300 are in UTM zone 16; all others in UTM zone 17.

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Table C-2

COAL ANALYSIS-AND SO_2 EMISSIONS[a]

ALLEN STEAM PLANT

Date	Coal Burned (ton/day)	Sulfur (%)	Btu/lb	SO_2 Emissions[b] ton/day	g/sec	lb/10^6 Btu
November 30-December 1, 1980	5677	2.2	11,669	243	2552	3.6[c]
December 17-18, 1980	5012	2.3	11,986	219	2300	3.6

a. Based on weekly coal analysis summaries.
b. Assumes 95 percent of sulfur evolves as SO_2.
c. SO_2 emission standard is 4.0 lb/10^6 Btu.

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APPENDIX D

Preliminary Modeling Analysis

MEASURED EXCESS OF AN AMBIENT SO_2 STANDARD

PRELIMINARY MODELING ANALYSIS

November 30-December 1, 1981

Plant: Allen

Period of Measured Excess: From 1600 on November 30, 1980 to 1500 on December 1, 1980.

Standard Exceeded: Primary (24-hour)

Monitor: 7

Location: Distance = 6.6 km; Azimuth = 66.5°
X (east) = 6.1 km; Y (north) = 2.6 km

Measured Average: 0.143 ppm

Plant Operation: Units 1-3 were operating and emitting a total of about 2500 g/s of SO_2 from three stacks, each 122 m in height. Plant operation was stable and SO_2 emissions were relatively constant during the period.

Meteorological Conditions: The meteorology during this period was dominated by persistent wind speed and direction. The average wind speed was about 12 m/s at the 110 m level. The average wind direction was 197° (blowing from), with a standard deviation of 3.7°; the minimum and maximum values of 1-hour average wind direction were 189 and 202°, respectively.

Modeling Results: The above values of minimum and maximum wind direction indicate that the plume direction would be between 9 and 22° off north, with an average direction of 17°. Since this is about 50° off the direction from Allen Steam Plant to the affected monitor, standard models would predict no concentration at this monitor.

Conclusion: SO_2 emissions from Allen Steam Plant did not contribute to the measured ambient SO_2 concentrations during this period.

MEASURED EXCESS OF AN AMBIENT SO_2 STANDARD

PRELIMINARY MODELING ANALYSIS

December 17-18, 1980

Plant: Allen

Period of Measured Excess: From 2100 on December 17, 1980 to 2000 on December 18, 1980.

Standard Exceeded: Primary (24-hour)

Monitor: 7

Location: Distance = 6.6 km; Azimuth = 66.5
X (east) = 6.1 km; Y (north) = 2.6 km

Measured Average: 0.144 ppm

Plant Operation: During most of the above period two units were operating and emitting a total of about 2000 g/s of SO_2 from two stacks, each 122 m in height.

Meteorological Conditions: The meteorology during this period was dominated by persistent wind speed and direction. The average wind speed was about 12 m/s at the 110 m level. The average wind direction was 203° (blowing from), with a standard deviation of 3.8°; the minimum and maximum values of 1-hour average wind direction were 195 and 209°, respectively.

Modeling Results: The above values of minimum and maximum wind direction indicate that the plume direction would be between 15 and 29° off north. Since this is about 45° off the direction from Allen Steam Plant to the affected monitor, standard models would predict no concentration at this monitor.

Conclusion: SO_2 emissions from Allen Steam Plant did not contribute to the measured ambient SO_2 concentration during this period.